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Sustainable Cayman
Est. 2014

Route corridor optioneering report

Assessment of route options for the East - West Arterial Road
in Grand Cayman. Produced by Sustainable Cayman with
support from the RSPB.



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Central Mangrove Wetland – Cayman Islands

1 Introduction

The East-West Arterial (EWA) Road Extension is a road-based scheme that covers a distance of over 16km between Hirst Road, to the west, and Frank Sound Road to the east, with various ‘spurs’ extending southwards to meet existing roads. The proposed route’s footprint is represented by a 16km long 49m wide multi-lane highway and associated roundabouts.

The National Roads Authority (NRA) is the proposer for the project. The project was first discussed in 2004 (then called ‘Central Highway’) when Hurricane Ivan caused damage to existing coastal roads. This meteorological event caused some areas of Bodden Town and Lower Bay / East End to be temporarily cut-off. This led to plans being drawn up to address the issues experienced, as well having an eye on climate change resilience, considering the vulnerability of existing infrastructure and communities to coastal storm events as well as to secure improved emergency vehicle access across the island.

The proposed road would traverse a substantial area of wetland habitat on the entire length of the southern perimeter of the Central Mangrove Wetland. It is estimated that a minimum of 124 acres would be directly cleared and deforested.

A consultancy has been commissioned by the NRA to produce an Environmental Impact Assessment (EIA) based on the published Terms of reference and is currently assessing route options in order to select a final alignment which the full EIA will be based on.

Aim of this report

The aim of this report is to show stakeholders the constraints and benefits of various alignments in order to show that there are potential alternatives to the currently proposed route, and for them to come to an informed decision on the best route option. The route selection process being carried out by the NRA consultants is not a public one therefore this report will aim to provide visibility and information to interested parties and the public.

This report is independent from the Government process and is not being used to inform its assessment but is here for information purposes only. The figures discussed are estimated and this report does not constitute an environment impact assessment.

2 Proposed route options

In this document we will be exploring three different road route alignments. The selection of a final alignment for a road is based on a comparison of costs and environmental and social impacts. Physical features of the area, such as topography, ground conditions, and surrounding land use, are important considerations in selecting a route; however this level of detail is not possible at this stage, based on the level of technical information available. After a route has been selected, a three-dimensional route alignment and its associated cross-sectional profiles are produced concurrently with the formal EIA. In the following sections, we will look at the factors that can influence route alignment and explore different options.

It is also important to remember that there is a wider issue which should not be ignored whilst looking at the alternatives discussed below. The traffic issues currently faced in the Cayman Islands cannot be solved by a new road in isolation, the planning of infrastructure and development needs to be looked at holistically and any development should be designed and planned with the best interests of the people in mind.

Public transport options need to be considered seriously whilst assessing route options for the road proposal. A report produced by Ardent¹ in 2023 shows the need for public transport and alternative options to a road to be considered seriously in order to solve the issues of the zones of congestion, none of the below options on their own will solve these issues. In September 2022 The Cayman Islands Government Ministry of Tourism and Transport commissioned Deloitte to produce an Assessment of a Public Transport Strategy². The preliminary assessment of costs for a solution to the traffic issues was estimated to be approximately \$30-35 million.

Fig 1 shows the three technically viable route alignments. The NRA proposed route is that which has been put forward by the NRA and is the currently publicly shared proposed route. Route 2 is an alternative route option proposed by Sustainable Cayman and the RSPB with the aim to avoid as much high value habitat as possible. Route 3 is an alternative alignment which would involve upgrading of current roads as well as the construction of new sections where required.

¹ Ardent Transport Review 2023 [Important Documents \(sustainablecayman.org\)](https://www.sustainablecayman.org/important-documents)

² <https://www.gov.ky/publication-detail/assessment-of-a-public-transport-strategy---final-report>

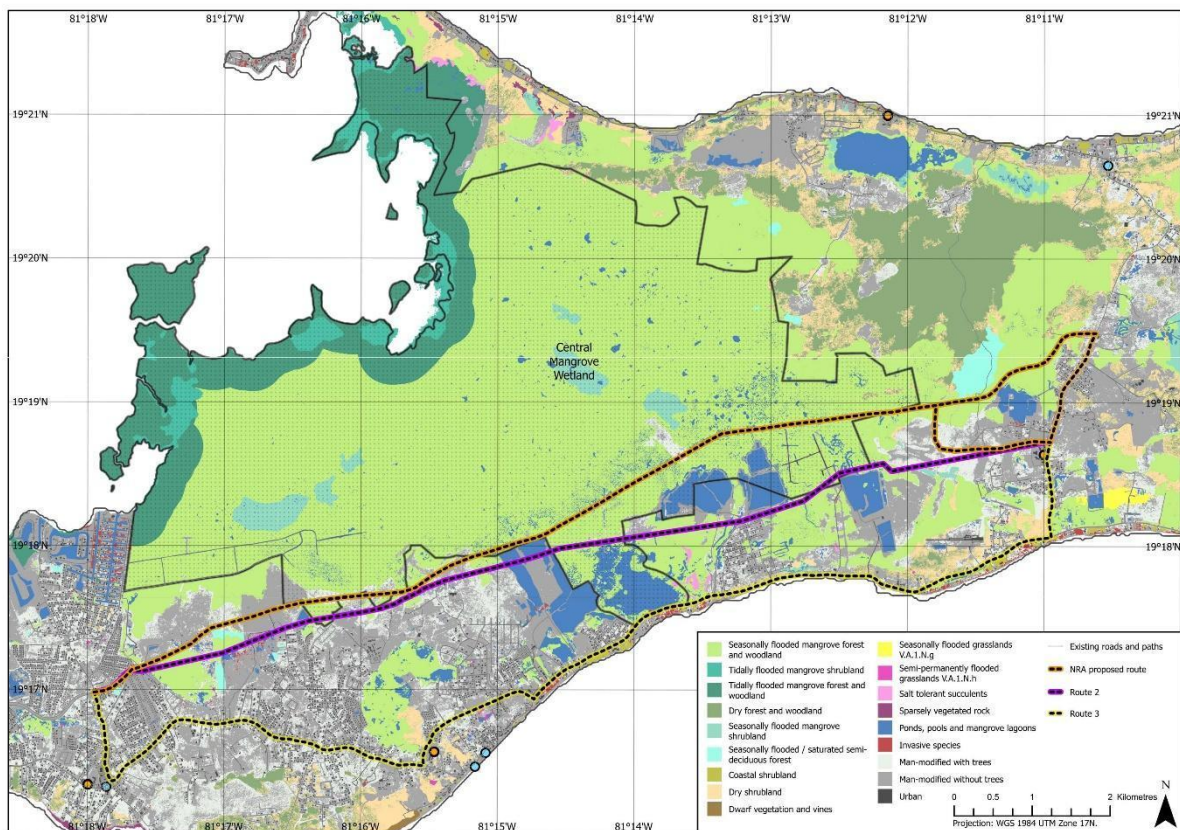


Fig 1. Three alternative route alignments of the East West Arterial road extension road scheme & habitat distribution.³

3 Appraisal methodology and topics of interest

This section lays out the 4 categories of impact we have used to assess and consider the best route alignment:

- i) social impacts & accessibility,
- ii) environmental impact,
- iii) climate resilience,
- iv) the potential cost of building the road.

This report will not assess to the same level of detail, the characteristics or configuration of the various route alignments as the official EIA consultants. However, we aim to give an unbiased perspective on the best option for the

³ BirdLife International (2023) World Database of Key Biodiversity Areas. Developed by the KBA Partnership: BirdLife International, International Union for the Conservation of Nature, American Bird Conservancy, Amphibian Survival Alliance, Conservation International, Critical Ecosystem Partnership Fund, Global Environment Facility, Re:wild, NatureServe, Rainforest Trust, Royal Society for the Protection of Birds, Wildlife Conservation Society and World Wildlife Fund. March 2023 version. Available at <http://keybiodiversityareas.org/kba-data/request>

Cayman Islands and its population based on data and knowledge we have with the aim to share knowledge and open up the discussion around alternative options for the public.

i) **Social impact**

Route alignments can have significant social impacts, such as changes in land use, community cohesion, and safety. The social impact and accessibility of road route options can be used to assess the best option in terms of how they affect the well-being, inclusion and equity of different groups of people and communities. Another important factor to consider when assessing different route alignments is accessibility. This includes factors such as travel time, distance, and ease of use for the public. As well as the proximity to areas of residential development and civic amenities as shown in Fig.3.

A road whose alignment would be closer to existing populations can have several advantages, including:

1. **Improved local connectivity:** a road closer to populations can improve local connectivity and accessibility, making it easier for people to reach their destinations, such as schools, hospitals, and shops.
2. **Increased economic activity:** a road closer to populations can increase economic activity by facilitating the movement of goods and services, as well as attracting more customers to local businesses, rather than being further from such facilities.
3. **Promoting active transportation:** a road closer to populations can promote physically active transportation, such as walking and cycling, by providing safe and convenient infrastructure for these modes.
4. **Safer vehicle speeds:** vehicular speeds are generally lower on more urbanised routes than those more distant from population leading to improved road safety.

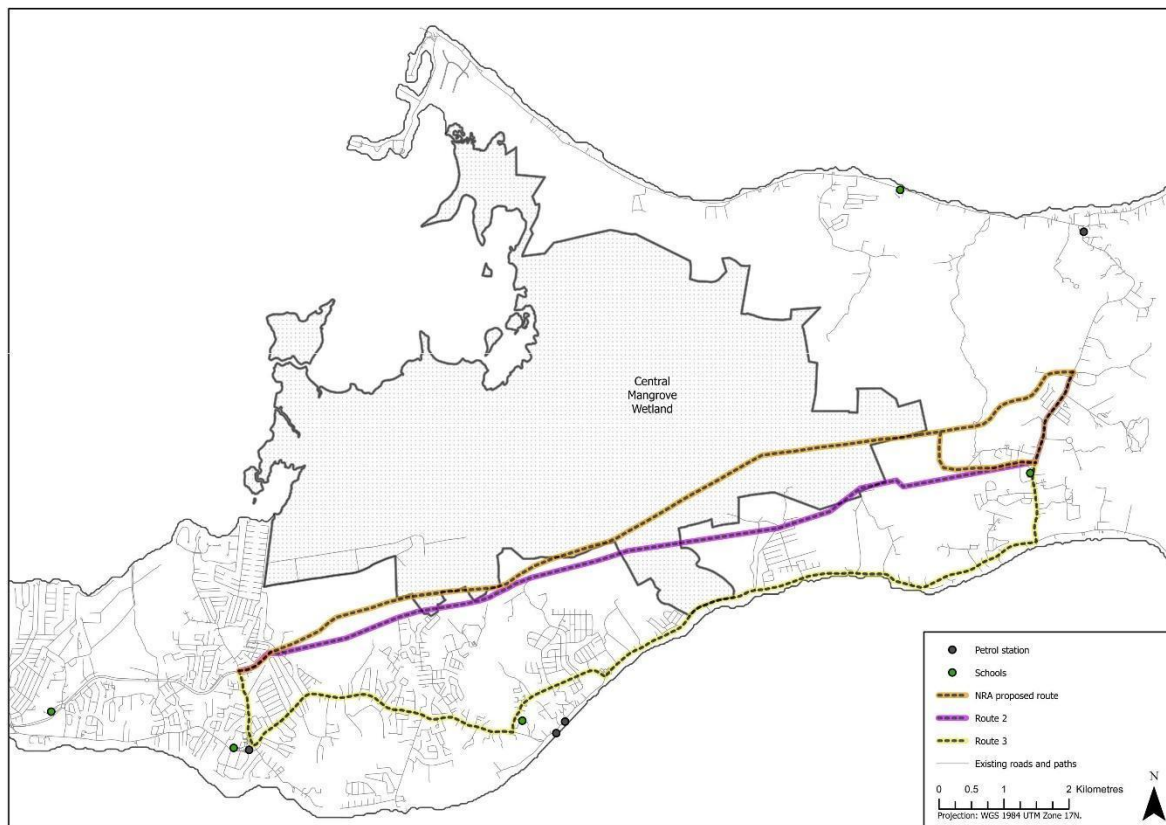


Fig.3 Location of civic amenities in relation to route options and connector roads.

ii) Environment

When assessing different route alignments, it is important to consider the environmental impacts of each option. When completing a full Environmental impact assessment (EIA), this would include factors such as air and noise pollution, habitat destruction, and carbon emissions. An EIA can help decision-makers to compare alternative design options, optimise the design features, and implement mitigation measures to minimise the environmental harm.

Within this assessment we will be looking at the direct impact on habitats of each route alignment. The footprint of each route alignment option will be considered in relation to the following habitat types identified in official data from the Cayman Islands Government⁴.

- Seasonally flooded mangrove forest and woodland
- Tidally flooded Mangrove shrubland
- Tidally flooded mangrove forest and woodland
- Dry forest and woodland

⁴ <https://www.yumpu.com/en/document/view/11975136/vegetation-classification-for-the-cayman-islands>.

- Seasonally flooded mangrove shrubland
- Seasonally flooded/ saturated semi-deciduous forest
- Coastal shrubland
- Dry Shrubland
- Dwarf vegetation and vines
- Seasonally flooded grassland
- Semi-permanently flooded grassland
- Salt tolerant succulents
- Sparsely vegetated rock
- Ponds, pools and mangrove lagoons
- Man modified with trees

It is also important to take into consideration the risk of secondary development, and which areas of land would be at risk of future development if they were to be opened up by new road development. This can be seen by the surrounding areas of untouched land which have potential for development which are within the vicinity of the road, and therefore will be accessible in the future. Fragmentation is a major driver of ecosystem degradation, reducing the capacity of habitats to provide many important ecosystem services. Research⁵ has shown that the distance to roads and fragmentation impacts the risk of future deforestation from secondary development. All routes can be given a risk factor in relation to the future potential damage to critical habitat as a result of the construction of the road.

Mangrove habitat is at great risk in the Cayman Islands and has already been degraded and lost in large amounts. There has been a loss of 72%⁶ of wetland habitat since 1976 from the west side of Cayman, this includes mangroves and sedge marsh. Any alternative which can limit future loss of mangroves will be crucial. Mangroves are important ecosystems that provide habitat for wildlife, carbon sequestration, and coastal protection including protection against storm surges which will continue to worsen as sea levels rise.

Meeting international lending standards: International Finance Corporation- Performance Standard 6

The International Finance Corporation, through Performance Standard 6 (IFC PS6), and the World Bank, through its equivalent environment standard ('ESS6'), have adopted a set of due diligence standards for lending practices. For example, under this adopted policy World Bank funds cannot be used to finance projects that would involve significant conversion or degradation of what is defined as Critical Habitat.

⁵ [Modelling deforestation using GIS and artificial neural networks - ScienceDirect](#)

⁶ [Mangrove disappearance DOE data](#)

This set of standards provides guidance on how to protect and conserve biodiversity, maintain benefits from ecosystem services, and promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities. IFC PS6 is a set of requirements that clients of the International Finance Corporation (IFC) must follow to protect and conserve biodiversity, maintain ecosystem services, and manage living natural resources sustainably. It is part of the IFC's Sustainability Framework, which aims to promote sustainable development and reduce environmental and social risks and impacts of the projects that the IFC supports.

Some of the key objectives of Performance Standard 6 are to:

- Protect and conserve biodiversity in areas of high biodiversity value, such as critical habitats and legally protected areas.
- Avoid, minimize, and mitigate the impacts of project activities on biodiversity and ecosystem services, such as provisioning, regulating, cultural, and supporting services.
- Apply the mitigation hierarchy to achieve no net loss or a net gain of biodiversity where feasible.
- Promote the sustainable use of renewable natural resources, such as fisheries, forests, and water resources, through the adoption of practices that integrate conservation needs and development priorities.
- Support the principles of responsible and inclusive management of living natural resources and respect the rights of workers and local communities.

Although the East West Arterial is not subject to PS6 as it is not a project funded by the IFC, it is commonly used as a standard for lenders to assess the most suitable options for projects. IFC PS6 presents five criteria to assess for projects in Critical Habitat.

- Criterion 1: The presence of threatened or endangered species or critical habitats.
- Criterion 2: The presence of species or habitats that are rare or unique to the region.
- Criterion 3: The presence of species or habitats that are important for maintaining ecosystem services.
- Criterion 4: The presence of species or habitats that are important for maintaining cultural values.
- Criterion 5: The presence of species or habitats that are important for maintaining the livelihoods of local communities.

It is noteworthy that these standards encourage net gain in biodiversity for infrastructure projects.

It will be useful to keep these standards in mind when considering the different route options.

iii) Climate resilience

Climate resilience is the ability of a system or community to cope with the impacts of climate change, such as extreme weather events and sea level rise. Climate resilience can be used to assess a route alignment by evaluating how well the road can withstand and recover from these impacts, as well as how it can contribute to reducing greenhouse gas emissions and enhancing sustainability.

A report produced by JNCC ⁷ indicates sea level rise risk and storm surge risk to the Cayman Islands. This information can indicate reasons why certain alignments will have the highest climate resilience as well as those which are at increased risk from sea level rise and extreme weather events. According to the IPCC Fourth Assessment Report, 2007, sea level around the Cayman Islands could rise by up to 1.15 metres by 2100 under a high emissions scenario.

More northerly areas of central Grand Cayman are at a much lower elevation than the Bluff areas found on its southern coastline, making them less resilient to future sea level rise.

iv) Estimated Cost

Assessing different route alignments also involves considering the costs associated with each option. This includes construction costs, maintenance costs, and the costs of any necessary land acquisition.

The cost of building a road per kilometre can vary significantly depending on various factors such as location, terrain, type of construction, number of lanes, lane width, surface durability, and the number of bridges.

Example variations in cost -

Rural area:

2-lane, undivided road: \$2-3 million per mile (\$1.25-1.86 million per km)

4-lane highway: \$4-6 million per mile (\$2.49-3.73 million per km)

6-lane interstate highway: \$7 million per mile (\$4.35 million per km)

⁷[Model development to assess the vulnerability of the Cayman Islands to storm surge and inland flooding, and the role and value of natural capital in mitigating the impacts \(jncc.gov.uk\)](http://jncc.gov.uk)

Suburban area:

2-lane, undivided road: \$3-5 million per mile (\$1.86-3.11 million per km)

4-lane highway: \$8-10 million per mile (\$4.97-6.21 million per km)

6-lane interstate highway: \$11 million+ per mile (\$6.84 million+ per km)

Elevated major freeway/interstate:

4 lanes, urban location: \$42.78-68.45 million per mile (\$26.62-42.59 million per km)

For this assessment we will use the estimated cost of \$4.30 million per km based on figures received from the Cayman Islands Government. To upgrade the existing route the cost estimate is \$2.4 million per km. These are as previously stated just estimates, and actual costs vary depending on specific circumstances (e.g. elevated overpass) and local factors (e.g. peat depths). The type of construction methodology will impact the cost considerably and the costs included in this report should be taken as a conservative prediction.

4 Review of Potential Strategic Options

	Social	Environmental	Climate resilience	Estimated Cost
NRA proposed route	This route does not provide the social benefits and accessibility improvements for today's population. There are no schools within 1km of the proposed main route and the alignment is away from areas of residential development, therefore it does not increase accessibility for emergency services or civic amenities to the current population. It acts as a relief road to traffic but bypasses the largest areas of residential population. It does however open up large swathes of untouched land which would be at great risk from secondary development. These areas currently are not accessible which reduces the risk of development pressures, building this route would increase the potential for urbanisation and thus additional 'indirect' impacts.	The proposed route put forward by the NRA would directly impact approximately 49.6ha of ecological habitat. With 33.6ha of that being Mangrove habitat. This is much larger than feasible alternatives. The option that goes through the most mangrove area should be avoided. This Route option also does not meet the IFC PS6 as there are other viable alternatives within the region that exist for development of the project which have less impact on mangroves which are a critical habitat. Mangroves have limited capacity to adapt to rising sea levels, especially if they are constrained by human activities or lack of sediment supply. Therefore, preserving the mangrove area is crucial for the long-term sustainability and resilience of the region. High risk factor in relation to secondary development due to the proximity of critical untouched habitat and the construction of the road. Would dissect the Mastic Trail possibly causing litigious conflict with the National Trust and Department of Environment who protect the area.	This route would also be more vulnerable to sea level rise as the route lies at lower height above sea level. This route should be excluded from the planning due to the projected sea level rise, which will increase the risk of flooding and erosion. According to the IPCC Fourth Assessment Report, 2007, sea level around the Cayman Islands could rise by up to 1.15 metres by 2100 under a high emissions scenario. This would make this route more vulnerable to storm surges, tidal waves, and saltwater intrusion.	The estimated cost for this route option is \$70 million – a conservative estimate caused by the likely need for viaducts and costly infill due to the large areas of wetland habitat.

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<p>Route 2</p>	<p>This route option has better accessibility meaning that it will facilitate the movement of people and goods. It would reduce the travel time and cost for individuals, gaining them extra time in bed, thereby addressing important public concerns raised in the consultation for the EIA Terms of Reference. It's proximity and connection to Midland Acres would provide a benefit to Bodden Town residents greatly improving daily traffic commutes, something not offered by the NRA proposed route. It is important at this stage to consider that with some proper planning connector roads from the coastal road by Midland Acres to Route 2 this would provide relief from traffic from the East onto the bypass, again not possible with the NRA proposed route. All traffic from the North would join along the Frank Sound Road connector thus easing the commute for all Eastern districts as well as the bottleneck in Bodden Town. Route 2 provides many more options such as the one outlined above for adding more benefits to the local population as well as future proofing these areas against increased traffic capacity.</p>	<p>One of the main criteria for choosing a route for a road project is the environmental impact. A route that has less direct impact on habitat means that it will affect fewer species and ecosystems, and preserve more natural resources. A route that has less risk of secondary development impacts means that it will minimize the potential negative effects of the road's construction and its operation. This route option causes less fragmentation of habitat and therefore has a Medium risk factor of secondary development as the amount of critical habitat in proximity to the road is lower than the NRA proposed route. It would thus provide a semi-defensible 'edge' to any secondary development, limiting the potential for encroachment. Would avoid damage to the Mastic trail.</p>	<p>This route option is also at similar risk from sea level rise. However due to less impact on mangrove habitat and with the majority of the route being away from flood-prone areas it is more climate resilient than the NRA proposed route.</p>	<p>The estimated cost for this route option is £61.90 million.</p>
<p>Route 3</p>	<p>This route option provides the biggest benefit in term of increasing access as it is closest to the highest number of schools and residential areas. However due to the upgrades and other associated construction works that would be required, it is prudent to assume that the local population would be subjected to a large amount of disruption. The alternative follows the existing road along the coast and would require upgrades or extensions to the existing road infrastructure. This route following the existing road is not a feasible option for the proposed project because it would require significant modifications to the existing infrastructure which has been shown by the NRA to be unfeasible. The existing road is narrow and winding, which makes it unsuitable for heavy traffic and large vehicles. Despite the potential for upgrades, improvements to existing roads would only provide limited relief.</p>	<p>Environmental impacts of this route would be minimal in comparison to the other route options due to alignment mainly with an existing footprint. However, it is unlikely to be a feasible option for the same reason. Low risk factor of secondary development due to low levels of critical habitat along the proposed route option.</p>	<p>This route option is also at high risk from hurricanes and extreme weather events. However, the land area has the highest elevation of all three routes so would be more climate resilient in relation to sea level rise.</p>	<p>The estimated cost for this route option is \$41.31 million. It is likely that the cost may be even higher due to the works having to fit around existing infrastructure</p>

Route options	Route distance (km)	Area of Habitat lost (ha)	Estimated cost (million \$)	Schools within 1 km radius (excluding connector roads)
NRA proposed route	16.31	49.6	70.10	1 (880 pupils)
Route 2	14.41	33	61.90	2 (1000 pupils)
Route 3	17.63	17	41.31	3 (1600 pupils)

Fig 4 Shows estimated habitat loss, cost, and accessibility data for all three route options.

5 Options Appraisal and conclusion

- Route 2 is the most economically viable new road option with a predicted costs being \$10 million below the NRA proposed route.
- All of the above route options will be affected by sea level rise, they will also all have a negative impact on the ecology of Cayman islands, which underpins the economy. However, the road which would offer the biggest potential immediate benefit to the local population for the Cayman Islands due to the connectivity to schools, residential areas and emergency services is Route 2.
- The proposed NRA route is likely to create more development pressures through indirect secondary development, compared to other routes which would better benefit current residents while providing a greater defensible edge of settlement(s). While there are benefits for developers with the NRA proposed route, the greater societal benefits are offered by Route 2.
- The NRA proposed route fails on a number of climate resilience criteria and its negative impact on storm surge protection, as well as limited accessibility and higher predicted cost.
- Route 3 has the lowest amount of environmental impact at end-state, as it minimises crossing sensitive habitats and minimises land use changes. However, its temporary impacts on residents during construction would be more significant.
- Route 2 provides a more climate resilient option, as it reduces impact on stormwater management. Therefore, a route that best satisfies the four identified criteria is Route 2, as it will balance the environmental, social, and economic aspects of the project. However, any route option should be considered holistically with other solutions such as public transport and development planning.
- Route 2 offers higher social benefits, as it improves accessibility, safety, and connectivity for local communities. Having better access to schools and other public amenities is important for local communities. Therefore, a route option which has better access to those public amenities offers significant advantages over one which acts solely as a bypass or relief road and would gain people extra time, no longer used for travelling.
- Route 2 offers greater benefits for future public transport options and cycling, by being better connected to existing populations.



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